ABSTRACT

Semiconductor devices and fabrication methods are provided, in which metal transistor gates are provided for MOS transistors. Metal boride is formed above a gate dielectric to create PMOS gate structures and metal nitride is formed over a gate dielectric to provide NMOS gate structures. The metal portions of the gate structures are formed from an initial starting material that is either a metal boride or a metal nitride, after which the starting material is provided with boron or nitrogen in one of the PMOS and NMOS regions through implantation, diffusion, or other techniques, either before or after formation of the conductive upper material, and before or after gate patterning. The change in the boron or nitrogen content of the starting material provides adjustment of the material work function, thereby tuning the threshold voltage of the resulting PMOS or NMOS transistors.